NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN ASSESSMENT OF THE WORLD WIDE EXPRESS (WWX) PROGRAM AND ITS EFFECTS ON CUSTOMER WAIT TIME (CWT) AND READINESS

by

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June 2001

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This thesis examines the benefits of implementing the Word Wide Express program to the Arabian Gulf. To perform this analysis, wholesale mean fill times were measured for items shipped via the Air Mobility Command and World Wide Express program. The Air Mobility Command and World Wide Express program data were then compared to determine how Customer Wait Time (CWT) and readiness were affected for Aircraft Carriers deployed to the Arabian Gulf. The second objective was to determine if World Wide Express program had an effect on customer confidence and determine the perception of the defense transportation service. A comprehensive analysis was conducted using data obtained through the RAND Corporation for four Aircraft Carriers deployed to the Arabian Gulf, two from each fleet. Our results indicated that the World Wide Express program does show improvements in wholesale mean fill time and Customer Wait Times for aircraft carriers deployed to the Arabian Gulf. These improvements translate to a minimal increase in readiness rates for Pacific Fleet aircraft carriers and no improvement for Atlantic Fleet aircraft carriers. Additionally, confidence levels were shown to be higher by survey participants when using the World Wide Express Program.

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ABSTRACT

This thesis examines the benefits of implementing the Word Wide Express (WWX) program to the Arabian Gulf. To perform this analysis, wholesale mean fill times were measured for items shipped via the Air Mobility Command (AMC) and World Wide Express program. The AMC and WWX program data were then compared to determine how Customer Wait Time (CWT) and readiness were affected for aircraft carriers deployed to the Arabian Gulf. The second objective was to determine if the WWX program had an effect on customer confidence and determine the perception of the defense transportation service. A comprehensive analysis was conducted using data obtained through the RAND Corporation for four aircraft carriers deployed to the Arabian Gulf, two from the Pacific and two from the Atlantic fleet. Our results indicated that the WWX program does show improvements in wholesale mean fill time and CWT for aircraft carriers deployed to the Arabian Gulf. These improvements translate to a minimal increase in readiness rates for Pacific Fleet aircraft carriers and no improvement for Atlantic Fleet aircraft carriers. Additionally, confidence levels were shown to be higher by survey participants when using the WWX Program.

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LIST OF ACRONYMS AND ABBREVIATIONS

3PL	Third Party Logistics
A_o	Operational Availability
AMC	Air Mobility Command
AOR	Area of Responsibility
B/O	Back Order
BPWG	Business Process Working Group
CAB	Civil Aeronautics Board
CENTCOM	Central Command
CNO	Chief of Naval Operations
CONUS	Continental United States
CRAF	Civil Reserve Air Fleet
CWT	Customer Wait Time
DAAS	Defense Automated Addressing System
DHL	Dalsey, Hillblom & Lynn
DLA	Defense Logistics Agency
DoD	Department of Defense
DOT	Department of Transportation
DTS	Defense Transportation System
FAD	Force Activity Designator
FedEx	Federal Express
FMC	Full Mission Capable
GATM	Global Air Traffic Management
GTN	Global Transportation Network
HMMVW	High Mobility Multi-Wheeled Vehicle
ITV	Intransit Visibility
JLWI	Joint Logistics Warfighting Initiative
LRT	Logistics Response Time
MAC	Military Air Command
MATS	Military Air Transport Service
MC	Mission Capable
MSC	Military Sealift Command
MSRT	Mean Supply Response Time
MTBF	Mean Time Between Failure
MTMC	Military Traffic Management Command
MTTR	Mean Time To Repair
NALO	Navy Air Logistics Office
NAVTRANS	Naval Transportation Support Center
NGSL	Next Generation Small Loader
NUFEA	Naval Unique Fleet Essential Airlift
OSA	Operational Support Airlift
RPG	Requirement Priority Group

SAAM	Special Assignment Airlift Mission
TDD	Time Definite Delivery
UMMIPS	Uniform Material Movement and Issue Priority System
UND	Urgency of Need Designator
USAF	United States Air Force
USTRANSCOM	United States Transportation Command
UPS	United Parcel Service
WWX	World Wide Express

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I. INTRODUCTION

As we enter the 21st century, our military forces have to react to global uncertainty. This uncertainty requires our warfighter to be more responsive, flexible and precise. In order to achieve our goal of full spectrum dominance, as outlined in Joint Vision 2020, we need to create a logistical system that can support our warfighters' needs. Joint Vision 2020 outlines an improved logistical system that will provide rapid crisis response; track and shift assets while enroute, and deliver tailored logistics packages and sustainment directly where needed.

Focused Logistics relies on the fusion of information, logistics, and transportation technologies. The desired end state of focused logistics will provide full spectrum supportability to the warfighter from source of supply to anywhere in the world. Additionally, it will improve the link between the operational component and the logistician resulting in precise time-definite delivery of assets.

In order to achieve this desired end state we first need to create a fully integrated Department of Defense (DoD) supply chain. Secondly, our logistical system needs to be performance based and able to be measured with specific metrics. Thirdly, our large inventories need to be replaced with agile, reliable manufacturing and time-definite delivery of products and services. Finally, our sourcing of material and services need to be determined by best value and not low cost provider. We need to balance organic and commercial support to provide the best quality of service and support to our forces.

A. OVERVIEW

1. Problem Statement

The United States Transportation Command (USTRANSCOM) and its air component, the Air Mobility command (AMC) joined forces with the civilian sector, and contracted services that will provide premium international transportation to the Department of Defense. The World Wide Express (WWX) program provides an express delivery service for global movement of high priority documents/packages. This program alleviates several factors compromising AMC's ability to complete their mission. (USTRANSCOM MSG, 1998) These include the retirement of the C-141 fleet, the constraints imposed on the aging C-5 fleet, and the decision not to replace the United States Air Force (USAF) fleet inventory of C-141s on a one for one basis with new C-17s. These conditions have made it challenging for AMC to provide the level of air logistics service that it provided in the past. Additionally, AMC has taken on a new operational concept to avoid "flying the wings off" the new C-17. (Brady, email. 1999)

AMC intends to transition to an operational philosophy where USAF strategic airlift will concentrate on satisfying missions directly appropriate for its organic aircraft. For example, AMC will concentrate on oversized, overweight, pallet train cargo, hazardous material, and classified material, as opposed to small package airworthy cargo. As the contracting component for airlift services, AMC has teamed up with Federal Express (FedEx), United Parcel Service (UPS) and Dalsey, Hillblom & Lynn (DHL) to form the WWX program. (Headquarters AMC, WWX Contract F11626-98-D-0030-32, 1998)

2. Purpose

This thesis examines the benefits of implementing the WWX program to the Arabian Gulf. We will determine what effect WWX has on Customer Wait Time (CWT) and readiness. A second objective is to determine if WWX will have an effect on customer confidence and their perception of transportation services. We will measure the variance in delivery times between AMC and WWX and determine if this variance has an effect on readiness.

B. SCOPE

We will compare the effects of using WWX on CWT and readiness for fleet units deployed to the Arabian Gulf. Specifically, it will compare WWX and AMC utilizing the CWT metric. Additionally, we will identify the affect that WWX has had on customer confidence. This thesis seeks to answer the following questions:

- What is the difference in CWT between AMC and WWX service during a deployment to in the Arabian Gulf?
- Does the WWX program improve CWT to fleet units during a deployment to the Arabian Gulf?
- Will full implementation of the WWX program improve readiness for deployed units to the Arabian Gulf?
- Does the WWX program provide better customer confidence than AMC?

C. BENEFITS OF THE STUDY/ORGANIZATION OF THE THESIS

This thesis primarily benefits Naval Transportation Support Center (NAVTRANS), the USTRANSCOM and AMC. The CWT analysis and program comparison will help NAVTRANS, USTRANSCOM, and AMC evaluate program implementation within the deployed fleet.

In order to provide a background to the commercial and organic organizations, Chapter II describes the history of the commercial and organic system and their effect on

the transportation of military cargo. Chapter III discusses the methodology used for the analysis. Then Chapter IV presents and analyzes the data obtained from the RAND Corporation and answers the research questions. Chapter V addresses the findings and their implications to the Navy, and provides recommendations for further research.

II. LITERATURE REVIEW

A. BACKGROUND

This chapter summarizes the literature relating to the transportation system in both the commercial and military sectors. This review discusses both systems and their current organization. A brief history of each system is provided. Following the history, the Navy logistical system is described, including the requirements for cargo transportation. Finally, we conclude this chapter with a brief overview of the WWX program and a history of the contract carriers.

1. Air Transportation

During the past 50 years, globalization has increased the need for air transportation to meet the demands of geographically dispersed businesses and people. The air transportation industry has grown into an increasingly significant portion of the United States economy. This growth, in part, is attributed to the far-reaching capabilities of aviation. The air transportation industry employs hundreds of thousands of people, and many more people in aviation support industries, such as hotels, rental car agencies and restaurants.

The air transportation industry consists of two components, passenger transport and air cargo. Belly cargo carried in passenger aircraft represents an overlapping of the two components. Continued economic growth and increased prosperity, combined with decreased airfares, has dramatically increased airline passenger leisure travel. The second component of the air transportation industry, air cargo, has increased in volume more rapidly than passenger volume over the past two decades. (Wells, 1998: 364) This

significant increase is attributed to new trends, such as e-commerce, just in time inventory and the overall increase of time sensitive deliveries.

Military air transportation involves moving large quantities of personnel, equipment and supplies globally to meet military requirements. In today's strategic environment, the importance of air transportation has dramatically increased due to a decline in force structure and a need to respond over long distances to overseas contingencies in an expeditious manner. (AMC Strategic Plan, 1999: Vol II, 2)

2. Organic Air Transportation

Organic air transportation which is a part of the Defense Transportation System is normally referred to as the DTS. Department of Defense Regulation 4500.9 - Defense Transportation Regulation, defines the DTS as:

> That portion of the worldwide transportation infrastructure which supports Department of Defense (DoD) transportation needs in peace and war. The Defense Transportation System consists of those military and commercial assets, services, and systems organic to, contracted for, or controlled by the DoD.

USTRANSCOM is the single manager of the DTS and is responsible for providing global transportation management. The DTS mission is to provide air, land, and sea transportation for the DoD, both in peace and time of war. USTRANSCOM includes three component commands: the USAF's AMC, the Army's Military Traffic Management Command (MTMC), and the Navy's Military Sealift Command (MSC). (USTRANSCOM, 1997: 1)

AMC's mission is to provide airlift, air refueling, special air mission, and aero-medical evacuation for U.S. forces. AMC is the single manager for air mobility during peacetime and wartime taskings. AMC provides all common-user air cargo lift

capabilities for the DoD. Their fleet includes several aircraft types that perform a variety of missions, ranging from heavy airlift to personnel transportation and in-flight refueling.

AMC airlift is centered on channel flights or channel service. "A channel is a regularly scheduled mission over a fixed route with capacity available to all customers" (Air Mobility Master Plan, 1997: 2-12). There are two types of channel flights: requirement channels and frequency channels. Requirement channels are airlift missions scheduled to support services between two points on a recurring basis, with actual movement subject to the volume of traffic. Frequency channels are initiated when traffic volume does not support desired frequency of service. These missions are specifically designated for operational necessity and to serve remote areas.

In the event that established AMC routes or channel flights do not meet the needs of the customer, Special Assignment Airlift Missions (SAAM) are available. AMC schedules SAAM flights utilizing the following criteria:

- Number of passengers
- Weight, size or characteristic of cargo
- Urgency or sensitivity
- Other special factors

SAAM missions are billed to the customer on a per-hour flying rate for the aircraft used. (USTRANSCOM, 1997: 10)

The Naval Air Logistics Office (NALO) is responsible for scheduling all Navy organic missions. The Navy Unique Fleet Essential Airlift (NUFEA) are Navy aircraft that provide air transportation to support Navy unique operational requirements, specifically, unpredictable, high priority, short notice airlift of people, cargo, and mail.

These missions are in direct support of those requirements that cannot be met by AMC channel flights or SAAM. (OPNAVINST, 1997: 2)

Operational Support Airlift (OSA) is another means to accomplish short-notice, intra-theater airlift of high priority passengers and cargo. OSA aircraft specialize in moving passengers and cargo where time and/or location constraints, mission sensitivity, security, load volume, or availability preclude using AMC channel flights, SAAM, or NUFEA aircraft. (Dyche, 1995: 197)

3. Commercial Air Transportation

In today's increasingly demanding logistics environment, rapid shipment has become a necessity. The door-to-door movement of time sensitive packages is key to many global industries and manufacturers. New trends, such as electronic commerce, shorter production cycles, just-in-time manufacturing and inventorying are demanding shorter delivery times and requiring more from the air cargo industry. The chief operating officer of DHL Europe recently commented that "The whole industrial world is behaving more like the fashion world, it's like musical chairs: no one wants to be caught holding obsolete stock. High-technology products such as semiconductors and medical equipment are the new perishable". (Tanzer, 1999: 2)

Increasing reliance on air shipment will continue to pressure the air cargo industry to provide faster, more reliable service. Rapid shipment has become a competitive advantage for many businesses and requires greater speed and agility from the industry.

In the past, the airline industry focused mainly on passenger transport and relegated most cargo transportation to air cargo carriers. Within the last year, the airline industry has realized the significant growth potential in express belly cargo. Major

airlines in Europe, North America, and Asia have announced plans or already introduced airport-to-airport time definite services. (Taverna, 1999: 4) In order to accommodate this added service, airlines are both utilizing their belly cargo space more efficiently and requiring aircraft manufacturers to design and build passenger aircraft with larger cargo carrying capacity.

Three companies, Federal Express (FedEx), United Parcel Service (UPS), and Dalsey, Hillblom and Lynn (DHL), dominate the airfreight industry. These companies are also known as "integrators" because they offer end-to-end air/surface movement. The express commercial carriers are responsive to customer demands and are able to adjust flight schedules and airlift capabilities to meet their customers' needs. They have structured their business practices to ensure speedy, reliable, and flexible cargo delivery.

B. HISTORY OF ORGANIC AIR TRANSPORTATION

1. Organic Air Transportation

Military aircraft were first used to move personnel and material on a large scale during World War II. The cargo and passengers moved by air were small compared to the total moved by sea and land, but demonstrated the significance that airlift would provide in future conflicts. In 1945, the Army Air Force's Air Transport Command operated over 3,700 planes worldwide. The Navy quickly followed by establishing the Naval Air Transport Service, which also moved personnel and material worldwide, operating 429 aircraft. In addition, both transport commands contracted with commercial carriers for additional airlift support. In 1947, the Air Force was established as a separate service, and took control of the Army's Air Transport Command. The following year, the Naval Air Transport Service and the Air Transport command combined to form the USAF Military Air Transport Service (MATS).

During the Korean War, the importance of military airlift was again demonstrated by the increase in cargo that MATS transported to the theater. Although reliance on MATS increased, civilian air carriers were used to satisfy all airlift requirements. U.S. flagged carriers moved 67 percent of the passengers, 56 percent of the freight, and 70 percent of the mail. (Whitehurst, 1976: 20) To help integrate civilian aircraft during contingencies, the Secretaries of Defense and Commerce established the Civil Reserve Air Fleet (CRAF) in 1951.

In the Vietnam War, MATS expanded its airlift capabilities. Additionally, CRAF-member carriers' aircraft were used extensively, although CRAF was not activated. U.S. airlines carried 90 percent of MATS passengers and 30 percent of MATS air cargo. (Whitehurst, 1976: 19-21)

MATS transitioned to the Military Airlift Command (MAC) in 1965. This name was changed to increase the strategic airlift role and solidify airlift doctrine within the Air Force's basic doctrine. This effort was championed by Congressman L. Mendel Rivers, who fought to modernize MATS and modify CRAF contracts, making them fair, equitable, and in the national interest. (Eichhorst, 1991: 23)

USTRANSCOM was established on 18 April 1987 and replaced the Joint Deployment Agency as the nation's command and control authority for mobilizing and deploying forces during wartime. USTRANSCOM was located at Scott AFB, Illinois, and included three component commands; the USAF's MAC, the Army's MTMC, and the Navy's MSC. In February 1992, USTRANSCOM was given increased authority and modified its mission to provide air, land, and sea transportation for the DoD, both in peace and wartime. This change created a single manager for the nation's defense

transportation system and created a cohesiveness in procuring commercial transportation services, activating sealift and airlift augmentation programs, controlling financial resources, and receiving transportation movement requirements. (USTRANSCOM, 1999:1)

AMC was formed on 1 June 1992, after deactivating MAC and Strategic Air Command. Its mission is to provide airlift, air refueling, special air missions, and aeromedical evacuation for U.S. forces. AMC is the single manager for common-user air mobility during peacetime and wartime tasking. (AMC, 1999:1)

C. HISTORY OF COMMERCIAL TRANSPORTATION

1. Commercial Transportation

The air cargo industry began in 1926, with National Air Transport, a predecessor company of United Airlines. Until 1940, the air express industry could not move cargo at significantly higher speeds than conventional land and sea transport. Additionally, inadequate aircraft carrying capacity rendered this form of cargo movement cost ineffective. In 1940, United Air Lines entered the airfreight business, providing air cargo service between New York and Chicago; by 1945, American, TWA, and United Air Lines were offering transcontinental air cargo services.

During World War II, 1942-1945, the Army's Air Transport Command and the Naval Air Transport Service generated more cargo movement than all of the commercial carriers combined during the same period. The conclusion of World War II generated excess cargo aircraft and trained pilots. The effective movement of air cargo during World War II provided the impetus for many military trained pilots to acquire surplus aircraft and recruit former military pilots to start airfreight transportation businesses. Of

the 14 all-cargo airlines established, two of the more prominent air cargo carriers were Flying Tiger Line and Seaboard World Airlines. These new airfreight carriers attempted to gain a foothold in the most profitable routes by offering lower rates per ton-mile than existing air carriers. By 1948, after the ensuing rate war, only six of the original fourteen air carriers were in business. In 1949, the Civil Aeronautics Board (CAB) issued experimental five-year certificates to four air cargo carriers to operate within minimum price per ton-mile rates. This helped establish rate structures and spurred air cargo industry growth.

The first all air cargo carrier, Seaboard World Airlines, began to offer transatlantic service in 1955. The decision by the CAB to allow subsidy-free transatlantic service was based on sufficient market growth and the threat of foreign air cargo carriers.

In 1961, the CAB removed the minimum rates established in 1948 due to the following environmental changes:

- The rate war that once existed no longer prevailed
- Domestic air freight rates stabilized above minimum rates
- Air freight capacity was expected to increase
- Jet aircraft were expected to lower unit cost
- Improved aircraft and ground handling procedures enabled greater flexibility in developing rate proposals

Expecting cutbacks in MATS contracts and increased competition from combination carriers using jet freighters, the all cargo carriers requested that the CAB restrict competition between the two groups. The all cargo carriers proposed restricting combination carriers to carrying freight in the aircraft bellies, leaving bulk cargo to the all cargo carriers.

The CAB revisited the rate structure again in 1970, and initiated the Domestic Airfreight Rate investigation. This process lasted seven years and was a comprehensive study on domestic airfreight rates, charges, and practices. Strong pressure from Congress and the administration brought deregulation to the airfreight industry in 1977. This opened competition in the domestic market by eliminating the CAB's control over market entry, exit and rate structure. (Taneja, 1979: 2-8)

The Boeing 747 jumbo jet played a significant role in air cargo industry growth. It began operating as a passenger aircraft in 1970. When used as a pure freighter, the 747 allowed combination carriers to transport large containers and to lift over 100 tons per trip. However, the combination carriers capitalized on the ability to carry passengers and subsidize their air cargo business using the excess capacity in the bellies of their 747 passenger aircraft. This load combination proved to be more cost effective and lowered airfreight rates. Following deregulation in 1978, virtually all combination carriers ceased operating freighter aircraft. Today, Northwest Airlines and Flying Tiger (Acquired by Federal Express in 1989) are the only original combination and all cargo U.S. carriers continuing to operate. (Wells, 1998: 369)

Market Entry and Exit Since 1978. National and Regional Air Carriers

			Reason for Leaving Market		
Entered Market	Exited Market	Still Operating	Merger	Waivers	Financial
205	132	73	23	22	87

Table 2.1. Market Entry and Exit since 1978. National and Regional Air Carriers. "From: Coyle, Bardi, and Novack, 1999: 175"

Today's air cargo industry is comprised of three types of carriers:

- Integrated carriers
- Combination carriers

- All-cargo airlines

Integrated carriers are also referred to as express carriers. They operate door-to-door freight transportation networks that include all cargo aircraft, delivery vehicles, sorting hubs and advanced information systems. To supplement their own aircraft capacity, and expand service range, integrated carriers utilize passenger airline belly cargo space. Examples of integrated carriers include FedEx, UPS, and DHL.

Combination carriers carry passengers and cargo on the same aircraft. These carriers primarily rely on freight forwarders for pick up and delivery, sales to shippers, and customer service. United Airlines is the leading combination carrier.

All cargo airlines provide point-to-point service for airfreight forwarders, either as common carriers or under guaranteed-space agreements. Some all cargo airlines, such as Atlas Air and Air Transport International, operate aircraft on a contract basis for other airlines. (Wells, 1998: 369-371)

D. NAVY AIR TRANSPORTATION REQUIREMENTS

1. Type of Material

The Navy's logistics system is very dynamic and demanding due to the nature of its deployed mission and global presence. Navy specific cargo can be defined as follows:

- **Material** – Supplies, repair parts, equipment, and equipage used by the Navy and Marine Corps. This material includes the following specific types of material:
    - **Hazardous Material** - Materials with inherent hazardous properties, that require special stowage, handling procedures, and transportation requirements.
    - **Classified Material** - Material that requires protection in the interest of national security.

Material transportation requirements are specified as follows:

- **Non-Air Transportable Cargo.** Any single piece of cargo that exceeds 1,453 inches in length, 144 inches in width, and 156 inches in height or that exceeds 1,453 inches in length, 216 inches in width, and 114 inches in height. Typically, this equipment cannot be loaded on a C-5 or C-17 aircraft.
- **Outsize Cargo.** Any single item that is smaller than the above dimensions but exceeds 1,090 inches in length, 117 inches in width, or 105 inches in height. Typically, this equipment is limited to the C-5 and C-17 aircraft, which were specifically designed to accommodate these cargo types. An example of an outsize piece of cargo, which is also roll-on/roll-off, is an M1A1 Abrams Tank.
- **Oversize Cargo.** Any air cargo that exceeds the usable dimensions of a 463L pallet loaded to a design height of 96 inches but is equal to or less than 1,090 inches in length, 117 inches in width, and 105 inches in height. An example of an oversize piece of cargo, which is also roll-on/roll-off, is a High Mobility Multi-Wheeled Vehicle (HMMVW).
- **Bulk Cargo.** Any cargo, including the 463L pallet itself, that is within the usable dimensions of a 463L pallet and within the height and width requirements established by the cargo envelope of the particular model aircraft. Basically, this is anything that will fit within the lateral limits of a useable 463L pallet of 88 inches by 108 inches or with tie down devices that occupies a space not greater than 84 inches by 104 inches. This category is also referred to as palletized cargo and is typically configured to fit any cargo aircraft type. (Source: AMC Strategic Plan, 2000)
- **WWX Size and Weight Limitations.** Letters and packages up to and including 150 pounds; as well as shipments consisting of multiple packages that may exceed 150 pounds in total weight. The size of an individual package shall not exceed 150 pounds or 108 inches in length and 130 inches in length and girth combined. (Headquarters AMC, WWX Contract F11626-98-D-0030-32, 1998)

2. Cargo Movement Priority System

Material is prioritized by the cargo's importance to the receiving unit. Transportation mode depends on cargo classification and priority levels. Priority levels are assigned according to the Uniform Material Movement and Issue Priority System (UMMIPS).

3. Urgency of Need Designator

The Urgency of Need Designator (UND) provides specific information to all management levels as to the requirement's importance for material requisitioned in the supply system. This requirement is assigned a priority, depending on the urgency of the material needed, and is specified in the below table.

Urgency of Need Designators (UND)		
A	B	C
CANNOT PERFORM MISSION	MISSION CAPABILITY IMPAIRED	REQUIREMENTS AND STOCK REPLENISHMENT

Table 2.2. Urgency of Need Designators.

4. Force Activity Designator

The Force Activity Designator (FAD) is a Roman numeral designator, established by each military service or the Joint Chiefs of Staff, which relates to the military necessity of the force or activity. There are five FAD code levels that depend on activity or unit relative importance to national objectives. The Secretary of Defense, Joint Chiefs of Staff, or designated DoD authority assigns these codes as outlined in OPNAVINST 4614.1 series. The table below shows the relative importance of each FAD and the level of mission required for assignment.

Force Activity Designator (FAD) Codes				
I	II	III	IV	V
COMBAT	COMBAT READINESS	DEPLOYMENT READINESS	ACTIVE RESERVE	OTHER

Table 2.3. Force Activity Designator Codes.

5. Uniform Material Movement and Issue Priority System

The UMMIPS takes into account two factors: the unit's UND and FAD. These two factors establish priority designators that range from 1-15. Priority groups 1-3 further classify these priority designators, to help move material by importance. The table below shows the proper priority designators based on FAD and UND.

UMMIPS Priority Matrix

FAD	A	B	C
I	1	4	11
II	2	5	12
III	3	6	13
IV	7	9	14
V	8	10	15

PRIORITY

Priority Groups

Priorities 1-3	Group 1
Priorities 4-8	Group 2
Priorities 9-15	Group 3

Table 2.4. UMMIPS Priority Matrix.

E. AIR FORCE AIR TRANSPORTATION

1. Air Mobility Command

AMC Headquarters is located at Scott Air Force Base, Illinois. AMC was formed in August of 1992 when the Department of the Air Force integrated tanker and airlift aircraft into a single team. AMC's primary mission is rapid, global mobility and sustainment for the U.S. Armed Forces. In addition, AMC provides aeromedical evacuation, aerial refueling, and airlift. Aeromedical evacuation provides wartime and peacetime medical transportation to military personnel and families. Aerial refueling increases the range, payloads and flexibility of American forces across the globe. As overseas bases close and the threat of multiple operational contingencies continues, aerial refueling will play an increasingly vital role to support airlift requirements. AMC's airlift mission includes moving combat troops, support personnel, DoD civilians, senior

government officials and cargo to and from points around the globe. AMC is the single point of contact with the commercial airline industry for procuring DoD domestic and international services and is responsible for administrating and executing the CRAF program.

Since its inception, AMC has played a vital role in supporting major contingencies and humanitarian operations around the world. AMC currently includes over 141,000 personnel. 52,000 are active duty personnel; the remainder are Air National Guard, Air force Reserve and civilian personnel. Additionally, AMC is responsible for 582 support aircraft valued at over 41.5 billion dollars. Their fleet includes numerous aircraft types that perform a variety of missions, ranging from heavy airlift and personnel transportation to refueling. AMC will reduce its number of strategic airlift aircraft from 392 to 246 by fiscal year 2006. This will be accomplished by retiring its entire fleet of C-141s. This reduction in aircraft does not decrease airlift capacity, because the C-17 has greater cargo capacity than the C-141. However, this will force AMC to find ways to meet multiple taskings with fewer aircraft. C-5 and C-17 aircraft will provide all strategic airlift. The following is a brief description of AMC airlift aircraft. (Air Mobility Master Plan, 1998: 2-29)

a. C-130 Hercules

The C-130 Hercules is used primarily for tactical airlift missions. The aircraft can operate in rough terrain and is principally used for airdropping troops and equipment into hostile areas. It has a maximum cargo capacity of 45,000 pounds, but it can also carry up to 92 combat troops. It has a range of 2,049 nautical miles when fully loaded. Inventory: Active force, 93, Air Reserve component, 296.

C-130 Hercules Aircraft Characteristics								
Range	**Payload**	**Speed**	**Wing span**	**Length**	**Takeoff Distance**	**Landing Distance**	**Number Aircraft**	**Crew Size**
2049 NM	45000 lbs	374 NM	132'	97'	2,750'	2,750'	389	5

Table 2.5. C-130 Hercules Aircraft Characteristics.

b. C-5 Galaxy

The C-5 Galaxy is one of two outsized cargo transporters in AMC's fleet. It carries a tremendous payload and is one of the largest aircraft in the world. It can be loaded simultaneously from the front and rear cargo openings. It has a load capacity of approximately 205,000 pounds and can carry enough fuel to fly 2,150 nautical miles fully loaded, or globally with in-flight refueling. Inventory: Active force, 50, Air Reserve component, 76.

C-5 Galaxy Aircraft Characteristics								
Range	**Payload**	**Speed**	**Wing span**	**Length**	**Takeoff Distance**	**Landing Distance**	**Number Aircraft**	**Crew Size**
2150 NM	205000 lbs	518 NM	229'	247'	8300'	4900'	126	7

Table 2.6. C-5 Galaxy Aircraft Characteristics.

c. KC-10A Extender

The KC-10A Extender is primarily designed for aerial refueling; however, it can carry 75 passengers and 170,000 pounds of cargo a distance of 3800 nautical miles. It has an unlimited range with in-flight refueling. It has a large side-loading door that can accommodate outsize cargo. Powered winches and rollers inside the cargo compartment move heavy loads.

KC-10A Extender Aircraft Characteristics								
Range	**Payload**	**Speed**	**Wingspan**	**Length**	**Takeoff Distance**	**Landing Distance**	**Number Aircraft**	**Crew Size**
3800 NM	170000 lbs	619 NM	165'	181'	10,000'	10,000'	54	4

Table 2.7. KC-10A Extender Aircraft Characteristics.

d. C-141B Starlifter

The C-141B Starlifter supports a vast variety of missions, but it's primary function is cargo and troop transport. It has a load capacity of 68,725 pounds of cargo or 200 troops. It has been AMC's backbone for many years, but is being replaced by the C-17. Range is unlimited with in-flight refueling. Inventory: Active force, 74, Air Reserve component, 96.

C-141B Starlifter Aircraft Characteristics								
Range	**Payload**	**Speed**	**Wing span**	**Length**	**Takeoff Distance**	**Landing Distance**	**Number Aircraft**	**Crew Size**
Global with Inflight Refueling	68725 lbs	500 NM	160'	168'	unk	unk	170	5

Table 2.8. C-141B Starlifter Aircraft Characteristics.

e. C-17 Globemaster III

The newest aircraft in AMC's fleet is the C-17 Globemaster III. The C-17 has a payload capacity of 170,900 pounds and can land and take off on runways as short as 3000 feet long and as narrow as 90 feet wide. It is AMC's most flexible cargo aircraft with its ability to provide heavy outsize/oversize cargo transport. (AMC, 1999: 1) Inventory: Active force, 58, Air Reserve component, 6.

C-17 Globemaster III Aircraft Characteristics								
Range	**Payload**	**Speed**	**Wing span**	**Length**	**Takeoff Distance**	**Landing Distance**	**Number Aircraft**	**Crew Size**
Global with inflight refueling	170900 lbs	450 NM	169'	174'	3000'	3000'	64	3

Table 2.9. C-17 Globemaster III Aircraft Characteristics.

2. Organic Air Trends

As AMC enters the 21st century, its priorities are to improve readiness by providing reliable, rapid personnel and equipment deployment. Additionally,

modernization and process improvement are areas of focus. Specifically, AMC plans to exploit state of the art technology to implement both the Global Air Traffic Management (GATM) system and new advances in cargo loading equipment.

To improve readiness, AMC initiated an aircraft modernization plan. Continuing to procure the C-17 Globemaster III is a top priority in AMC's modernization efforts. AMC currently has 36 C-17s in its inventory. While this aircraft's direct delivery capabilities make it an obvious successor to the retiring C-141, AMC plans to procure an additional 98 C-17s, to bring the total purchase to 134 aircraft. To meet the challenges of C-5 Galaxy readiness, AMC has developed a comprehensive upgrade plan for this aircraft. This plan includes installing high-pressure engine turbines, modernizing avionics, and re-engining. AMC is confident that these upgrades will enhance performance and allow the C-5 fleet to continue its outsize/oversize service. Finally, following its successful deployment in Kosovo, the KC-10A Extender will receive upgrades to improve navigational capabilities as well as crew operational safety.

To meet the military unique requirements of loading and unloading aircraft, AMC has already purchased 52 additional Tunner aircraft loaders, for a total complement of 86; AMC plans to purchase a total of 318 loaders. Tunner loaders have a 60,000-pound, six-pallet capacity and are replacing the aging 40,000-pound loaders. According to General Ronald R. Fogleman, the former Commander In Chief of USTRANSCOM, "The 60K loader is probably the single most important piece of equipment coming down the road for the AMC." (Fogleman, 1995:49) In a continuing effort to acquire state of the art material handling equipment, AMC is testing the Next Generation Small Loader (NGSL). The NGSL eventually will replace 264, 1960s era 25,000 pound loaders.

AMC has initiated process improvements in their global air transportation systems and in their information systems. The GATM system and the Global Transportation Network (GTN) are current projects to improve AMC's in-flight safety and core business practices. GATM is designed to ensure synergistic operations within the global air transportation system. The enhancements provide worldwide air route access, avoiding delays and uneconomical routing that would compromise cargo loading and increase fuel usage. Without these upgrades, air mobility fleet's effectiveness could be reduced force movement by as much as 25 percent. GATM modernization includes global positioning systems, traffic alert and collision avoidance systems, and enhanced ground proximity systems. These systems will ensure reduced vertical separation between aircraft, while also allowing the pilot more flexibility in selecting flight routes and altitude. (Air Mobility Master Plan, 1998: 1-15)

The GTN is an automated command and control information system being developed by the United States Transportation Command. GTN integrates supply, cargo, passenger, and unit requirements and movements with airlift, air refueling, and sealift schedules to provide in-transit visibility of personnel, materiel, and military forces. The system also provides a planning capability for current and future transportation operations and furnishes the movement and scheduling portion of the Global Command and Control System. (AMC stakeholder report, 1999: 4-20)

F. COMMERCIAL EXPRESS AIR CARRIERS

1. Federal Express

FedEx is the creation of a Yale University student named Fred Smith, who wrote an essay in the mid 1960s that criticized the existing airfreight industry. Smith believed that the airfreight industry could not grow as a complement to passenger service due to

the different route structure that each service required. Additionally, he believed that costs would not decrease with volume. Finally, commercial airlines could not provide better than two-day delivery service, so they would not attract customers that already received that level of service at much lower costs thru the trucking industry. Smith proposed a centrally located air cargo system serving both large and small cities; most importantly it focused on the package not the traveler. To fully implement this system, Smith bypassed CAB rules by launching a business in 1973 that used small jets carrying less than 7500 pounds of cargo at a time. He created a single hub in Memphis, Tennessee that housed hangars and corporate facilities. This hub served as a transfer point for all packages traveling throughout the United States. All aircraft landed in Memphis by midnight and offloaded all packages for sorting. All packages were loaded back on to the aircraft and flown out to their final destination in the early hours each morning.

To entice the Federal Reserve Bank as its first major customer, Fred Smith named his company Federal Express. The Federal Reserve Bank moved a large volume of checks around the country daily; Smith believed that his company would be the perfect service provider. Although he did not get the contract with the Federal Reserve Bank, FedEx has become the leader in the overnight delivery business. (Heppenheimer, 1995: 317-318)

Today, FedEx is the world's largest express transportation company. Headquartered in Memphis, Tennessee, it has international headquarters in Asia, and Europe. FedEx employs more than 150,000 people worldwide in over 200 countries. FedEx operates an aircraft fleet of 640 planes and owns over 44,500 vehicles. They

handle an average of 3.2 million packages everyday, generating 14 billion dollars in revenues during fiscal year 1999. (FedEx Webpage, 2000: 1)

2. United Parcel Service

In 1907, James Casey formed the American Messenger Company in Seattle, Washington, to meet the growing need for private messenger and delivery service. Following years of expansion, the name United Parcel Service was adopted in 1930. The word "United" was selected because shipments were consolidated and "Service" because the company believed that service was all they offered.

UPS began offering two-day service to major cities on the East and West coasts in 1953. Packages flew in the cargo holds of regularly scheduled airlines. The service was called UPS Blue Label Air. This service grew, and by 1978 was available in every state, including Alaska and Hawaii.

In the 1980's, following federal airline deregulation, the combination carriers reduced the number of cargo flights, in some cases eliminating the service. UPS began to assemble its own fleet of aircraft, and by 1988 it had entered the overnight air delivery business. UPS Next Day Air service was available in all 48 states and Puerto Rico. Alaska and Hawaii were later added. Additionally, UPS launched their own international air package service linking the US and six European nations.

Today, UPS is the largest package delivery service in the world, headquartered in Atlanta, Georgia with over 10 air hubs worldwide. UPS employs more than 326,000 people in over 200 countries. UPS operates an aircraft fleet of over 220 planes, charters an additional 300 planes and maintains a fleet of over 157,000 vehicles. The firm

handles an average of 12.4 million packages daily, generating 25 billion dollars in revenues in fiscal year 1999. (UPS Webpage, 2000:1)

3. DHL Worldwide Express

Adrian Dalsey, Larry Hillblom and Robert Lynn (D, H, and L) founded DHL Worldwide Express in 1969. This company started as a shuttling service for bills of lading between San Francisco and Honolulu. As the express package business was expanding in the United States, DHL initiated service to the Philippines, Japan, Hong Kong, Singapore and Australia, creating an entirely new industry of international door-to-door express service in the Pacific Basin. Expansion continued throughout the 1970's, and DHL extended it services to Europe (1974), Latin America (1977), the Middle East (1978), and Africa (1978).

Today DHL is a major leader in global package movement and cargo. DHL is headquartered in San Francisco, California, with over 34 hubs and 275 gateways worldwide. DHL operates a fleet of over 220 aircraft and employs over 600,000 personnel globally. Additionally, the firm maintains a fleet of over 17,450 vehicles, and handles an average of 538,000 packages everyday, generating six billion dollars in revenues in fiscal year 1999. (DHL Webpage, 2000:1)

4. Industry Trends

The air cargo industry continues to expand and attract more businesses. The market for air cargo service is expected to grow by as much as 6% to 6.5% annually over the next two to three years, reaching double digits growth by 2005. (White, 1999:1) World air cargo traffic is projected to more than triple to 450 billion ton-kilometers in 15 years. One-third of that cargo is projected to be handled by fully integrated freight

providers, as compared to 4% in 1997. (Taverna, 1999: 4) A significant trend in the industry is teaming between air carriers and both third-party logistics providers and freight forwarders, to provide integrated service as offered by companies like Federal Express (FedEx) and DHL. (White, 1999:1)

To keep up with industry growth, airlines have increased their demand for freighters. Boeing reports that fifty percent of 747 aircraft construction in the first half of 2000 will be freighters. Additionally, they expect the world freighter fleet to double by the year 2017, increasing from 1,434 to 2,706 aircraft. Boeing forecasts that large body aircraft will account for 30% of that total; the remaining 70% will include modified passenger aircraft. (Schwartz, 1999:2)

G. COMMERCIAL EXPRESS PACKAGE CONTRACT

1. World Wide Express

The WWX program was awarded to FedEx, UPS, and DHL in October 1998 and has been extended through fiscal year 2000. Each carrier was awarded a region or multiple regions of service. FedEx received the European, Central, Pacific, and Southern Theaters; DHL received the European and Pacific Theaters; and UPS received the Central Theater.

The contract involves international commercial small package express service. It was established to handle packages of 150 pounds or less, as well as multiple package shipments that may exceed 150 pounds in total weight. The WWX contract excludes classified or sensitive materials. FedEx is the only carrier currently handling hazardous material. Items not handled by WWX will continue to be serviced by AMC. Carriers provide time definite service with door-to-door pick-up and delivery. Intransit visibility

is offered through both the World Wide Web and GTN, which is maintained by USTRANSCOM. GTN provides real time visibility of package movement and destination arrival. (Hasstedt, 1999:1)

The WWX program is mandatory for all DoD and federal government agencies. The Defense Logistics Agency (DLA) has also integrated Third Party Logistics (3PL) providers as well as Prime Vendors into the WWX program. Mandating that DoD and federal agencies use WWX and integrate 3PLs and Prime Vendors facilitated successful negotiations for extremely competitive rates and services. (Hasstedt, 1999:1)

The WWX contract requires participation in the CRAF program. The CRAF program was established in 1951 to augment U.S. military airlift forces with civilian air carriers to support emergency airlift requirements. It was initially structured to counter a Soviet invasion of Europe.

The DoD manages the CRAF contract and the Department of Transportation (DOT) is responsible for coordinating and allocating civilian aircraft during wartime. USTRANSCOM is DoD's representative for contract formulation and ensures that all aspects of the contract are consolidated into a single document. Under CRAF, U.S. air carriers voluntarily commit cargo and passenger aircraft to support airlift requirements that exceed AMC capabilities. The WWX contract requires awarding all DoD domestic air transportation contracts over 30 days in length to CRAF members. CRAF provides more than 50 percent of AMC's long-range international strategic airlift capabilities. CRAF participants played a tremendous role in supporting Operations Desert Storm and Shield, flying over 5,600 missions. (Spehar, 1999:1-2)

In the event of a crisis, the WWX contract has a transition to war clause to ensure that packages continue to their final destination without being returned to the shipper. This clause, along with guaranteed insurance for aircraft loss or damage, provides substantial security to the government shipper.

H. SUMMARY

This chapter introduced the military and commercial air transportation systems. Additionally, the historical background of AMC and of the commercial air cargo industries, along with the Navy's air transportation requirements, were summarized to illustrate the necessity for having a responsive transportation system. Finally, the current AMC and commercial air cargo industry and the WWX program and its contract carriers were reviewed to introduce the basic impetus for this study. The following chapter will introduce the methodology that will be used to compare the WWX program and AMC organic airlift, and define the metrics used in our study.

III. METHODOLOGY

A. INTRODUCTION

This chapter will outline the methodology used in comparing CWT between AMC and the WWX Program in the Arabian Gulf. Initially, this chapter restates the current problem and defines the fundamental objectives underlying this research. An in-depth description of the metric tools used during the research will then be presented. The chapter concludes with a theoretical relationship between CWT and readiness and a brief description of our metrics.

1. Research Focus/Objectives

This research analyzes the movement of material from the Continental United States (CONUS) to the Arabian Gulf. The primary purpose of this research is to determine; 1) whether mean CWT for the WWX Program is lower than the mean CWT for AMC to the above location, and 2) if the WWX program provides improved operational availability for deployed fleet units in the above listed area. To fully examine the impact of each transportation system, the following measurement questions will be answered.

2. Measurement Questions

- What is the difference in CWT between AMC and WWX service during a deployment to in the Arabian Gulf?
- Does the WWX program improve CWT to fleet units during a deployment to the Arabian Gulf?
- Will full implementation of the WWX program improve readiness for deployed units to the Arabian Gulf?
- Does the WWX program provide better customer confidence than AMC?

B. METRIC ANALYSIS TOOL

Logistics Response Time (LRT) has been a key measurement tool since the early 1990s. It captured transactions that were processed through the wholesale system and measured the wait time in the numerous processes that made up the time customers waited for material. Focused Logistics, as envisioned in Joint Vision 2020, replaces LRT with CWT to capture the effect of all inventories, including those pre-positioned at the retail level, and link the relationship between CWT and readiness.

1. Background

The DoD Logistics Strategic Plan provides DOD's guiding principles for supporting Joint Vision 2020 and provides a path to implement Focused Logistics. The DoD and Joint Staff is the driving force behind the logistical transformation that will provide real-time situational awareness and meet the material needs of theater commanders. To achieve this logistical transformation, the following goals have been established:

- Accelerate progress in implementing CWT as a key logistics metric in FY 01
- Adopt a simplified priority system by FY 02
- Achieve accurate total asset visibility and accessibility by FY 04
- Field a web-based, shared data environment providing seamless, interoperable, real-time logistics information from the Department early deploying forces by FY 04 and to the remainder of the forces by FY 06. (CWT-TDD FRD, 2000 p. 3)

2. Customer Wait Time

CWT, as defined by the DoD Logistics Strategic Plan, is the "total elapsed time between issuance of a customer order and satisfaction of that order." The CWT working group established to implement this metric further describes CWT as follows:

- CWT is a beginning to end measurement that is demarcated by an initiating event (customer's documented requirement) and a terminating event (customer acknowledges receipt)
- CWT also measures different and successive segments of the supply chain by separating each segment and identifying those segments where deficiencies exist. This process focuses attention where key gains can best be achieved to improve overall CWT.
- CWT is measured and displayed in days at the 50, 75 and 95 percent variance basis. This is done to tie CWT to Time Definite Delivery (TDD), which will increase the customer's confidence in the supply chain.

CWT is calculated by subtracting the request date from the receipt date on each request to measure the elapsed time. CWT takes into account all transactions to include retail, maintenance actions, wholesale, procurement and depot level repair. The CWT metric is an important statistic in establishing the new requirement priority group that is fundamental to TDD.

3. Time Definite Delivery

TDD is a standard of elapsed delivery time that a customer can expect when they submit a requirement. It is expressed as CWT in number of days. Table 3.1 is the customer's Requirement Priority Group (RPG) and is based on RPG and geographical location. The Joint Logistics Warfighting Initiative (JLWI), a sub-group of the Business Process Working Group (BPWG), established this table for the Central Command Area of Responsibility (CENTCOM AOR).

	Urgency of Need Designator (UND)		
Force Activity Designator (FAD)	A	B	C
I	01	04	11
II	02	05	12
III	03	06	13
IV	07	09	14
V	08	10	15

Urgent = Priority Group (PG) I Immediate = Priority Group (PG) II Routine = Priority Group (PG) III

Table 3.1. Customer Requirement Priority Group.

Establishing and meeting TDD standards allows customers to know what level of service to expect. By achieving these standards over time, customers will begin to gain confidence in the supply chain system. Since TDD is not a measurement of service inventory, but rather a standard to gauge the effectiveness of the supply chain, it is a valuable tool for customers to evaluate the system. Finally, the combination of the CWT metric and TDD proposal helps the supply chain to measure performance at each link and identify business processes needing improvement. Table 3.2 provides an example of TDD standards for retail issues and Back Orders (B/O) measured in days that have been established for the CENTCOM AOR. (J4 JLWI Experimentation Proposal, Jun 00)

Customer Wait Time Metrics (JLWI-CENTCOM)*				
	Retail Pass (-) B/O	Retail Pass B/O Only	End to End (-) B/O	End to End B/O Only
1	4	8	5	10
1	7	14	8	16

Table 3.2. Customer Wait Time Metrics

4. Customer Wait Time Relationship to Readiness

In the fleet, the relationship between CWT and Operational Availability (A_o) is linked to high priority requests for organizational level material ordered in organizational level maintenance systems. The underlying relationship between customer wait time for maintenance related items and readiness are strong. The basic relationship of A_o to customer wait time is contained in the formulae below:

$$A_0 = \text{Up Time / Total Time} \Rightarrow$$

$$A_0 = \text{Up Time / (Up Time + Down Time)} \Rightarrow$$

$$A_0 = \frac{\text{Mean Time Between Failure}}{\text{Mean Time Between Failure + Mean Time to Repair}} \Rightarrow$$

$$A_0 = \frac{\text{MTBF}}{\text{MTBF + MTTR (less time awaiting parts) + MSRT}}$$

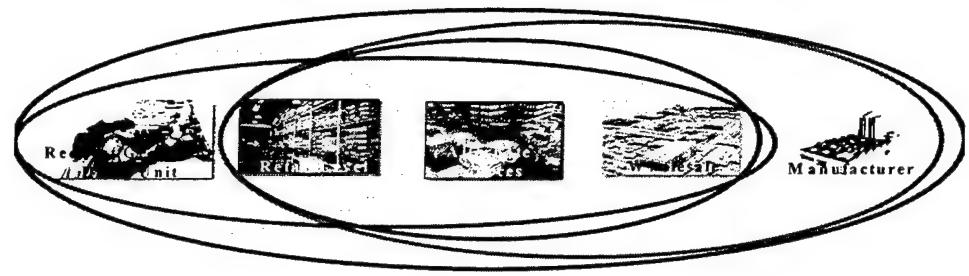
$$A_0 = \frac{\text{MTBF}}{\text{MTBF + MTTR (less time awaiting parts) + CWT}}, \text{ where}$$

MTBF = Mean Time Between Failure
MTTR = Mean Time to Repair
MSRT = Mean Supply Response Time
MSRT = Customer Wait Time (NAVSUP PUB 553, 1983)

5. Application of Metrics

To answer the two primary thesis questions, we will utilize the metrics described above in the following manner. Initially, we will utilize the CWT metric to measure wholesale requisition data obtained from the RAND Corporation for Pacific and Atlantic fleet carriers deployed to the Arabian Gulf. Our focus will be on those items that cannot be initially satisfied at the unit level. Therefore, we will capture those items that require transportation from point of issue to customer receipt. To calculate the true CWT, we will use the CWT Calculator developed by Commander Jim Hoover. The CWT Calculator uses excel to formulate the expected CWT accounting for all transaction levels depicted in Figure 3.1.

CWT Measurement Environment



(1) Retail Issues; (2) Retail Pass Minus Backorders; (3) Retail Pass Backorders Only; (4) End to End Minus Backorders; and (5) End to End Backorders Only.

Figure 3.1. CWT Measurement Environment.

The CWT calculator computes the expected CWT using the probability percentage of filling a requisition at each level of the supply system along with the mean time to fill a requisition at each level measured in days. The CWT calculator multiplies the two variables and the sum of these values is the CWT in days. The CWT calculator is depicted in Figure 3.2 and represents the notional figures for an aircraft carrier expected CWT. (Hoover, 2000)

Supply Chain Category	Probability of Fill at this level	Mean Time to Fill (days)	Cumulative Prob of Fill
Retail Gross Effectiveness	75.0%	0.2	75.0%
Intermediate Repair	66.0%	3.0	91.5%
Wholesale Material Availability	70.0%	12.0	97.5%
Depot Repair	90.0%	90.0	99.7%
New Procurement	10.0%	365.0	100.0%

Expected CWT 4.4

Figure 3.2. CWT Calculator.

Using the historical probability and mean time to fill numbers in Figure 3.2, along with the actual wholesale mean delivery time obtained from the data for WWX and AMC, we will calculate their expected CWT. These results will then be used to assess the affect that the expected CWT's have on operational availability using the mathematical formula discussed in this chapter. Additionally, a 90 percent confidence level analysis will be conducted on the data to test its sensitivity. Lastly, we will survey afloat units and ashore staffs to measure customer confidence of both AMC and the WWX program

C. SUMMARY

This chapter outlined the research methodology that will be followed in this study. It initially identified the overarching research objectives: 1) whether mean CWT for the WWX Program is lower than the mean CWT for AMC organic airlift to the Arabian Gulf and Mediterranean 2) if the WWX program provides improved operational availability for deployed fleet units to these areas. The specific measurement questions that must be answered to meet these objectives were presented. These were followed by a description of the metrics and how they will be employed. The following chapter will present the analysis and results obtained by applying this methodology.

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IV. ANALYSIS AND RESULTS

A. INTRODUCTION

This chapter analyzes the data, and answers the research questions presented in the first chapter. Restated for the reader:

1. Purpose

This thesis determines the benefits of implementing the WWX program fleet wide when deployed to the Arabian Gulf. We will determine what effect WWX has on CWT and readiness. A second objective will be to measure the variance in delivery times between AMC and WWX and determine if there is an effect on readiness. Finally, we will determine if WWX will have an effect on customer confidence and their perception of transportation services.

From the purpose statement, the following research questions were derived:

- What is the difference in CWT between AMC and WWX service during a deployment to the Arabian Gulf?
- Does the WWX program improve CWT to fleet units during a deployment to the Arabian Gulf?
- Will full implementation of the WWX program improve readiness for deployed units in the Arabian Gulf?
- Does the WWX program provide better customer confidence than AMC?

B. DATA ANALYSIS

1. Data Collection

The requisition data used for this analysis was obtained from the RAND Corporation with the assistance of Mr. Marc Robbins. It was collected from archived Defense Automated Addressing System (DAAS) information during the time period January 2000 through February 2001. The requisitions were gathered for Pacific and

Atlantic Fleet aircraft carriers deployed to the Arabian Gulf during the above time frame. The Pacific and Atlantic Fleet aircraft carriers which met the time frame criteria and were selected for the study are: USS ABRAHAM LINCOLN, USS JOHN C STENNIS, USS GEORGE WASHINGTON and USS DWIGHT D EISENHOWER. The time frame limitation was based primarily on the accuracy and availability of requisition data.

The data population for this study was exclusively Issue Priority Group I requisitions, focusing on priority 2 material and aviation GOLF and DELTA series documents. GOLF and DELTA series documents represent high priority aviation requirements that affect the mission capability of aircraft.

Hazardous Material requires special handling and associated paperwork. Aircraft are limited to the authorized quantities determined by the type of hazardous material. AMC carries the majority of hazardous material compared to WWX. To ensure we examined a consistent data set, we removed all hazardous material requisitions.

When comparing the CWT between AMC and WWX, the data focused on the wholesale segment. The wholesale segment represents those items not available at the retail level (on-ship), and not repairable at the intermediate maintenance level. Therefore, the data consisted of only those requisitions ordered from off ship sources requiring shipment to the ship via AMC and WWX channels. In order to get an accurate measurement of delivery times, the data was cleansed and 44 requisitions out of 7162 were removed due to missing or inaccurate data fields.

The time to fill date (measured in days) for each wholesale requisition was computed using an Excel spreadsheet for each aircraft carrier. This was accomplished by subtracting the date the requisition was ordered (identified by the Julian date of the

requisition) from the D6S date (shipboard receipt date). Once the time to fill date was computed for AMC and WWX, the wholesale mean time to fill date was computed. The wholesale mean time to fill measured in days for both transportation modes was then inputted into the CWT Calculator to determine the overall expected CWT for the deployment. CWT figures were computed for each aircraft carrier deployment and then combined to identify the Pacific and Atlantic Fleet CWT.

2. Comparison of Customer Wait Times

Table 4.1 presents the findings for the Pacific Fleet aircraft carrier USS ABRAHAM LINCOLN. The mean time to fill for the wholesale segment for AMC was 30.6 days, and 28.0 days for WWX. The 2.6 days difference represents the time a requisition takes to be filled from the material order date to the time it is received onboard the ship. This 2.6-day decrease in mean fill time for WWX translates to a 0.2-day advantage in expected CWT when computed using the CWT calculator.

UIC	Mode	# of Document	Wholesale Mean Fill Time	90% Confidence Wholesale Mean Fill Time	Expected CWT	90% Confidence Expected CWT
R21847	AMC	1903	30.6	29.5 - 31.7	5.5	5.4 – 5.5
	WWX	110	28.0	20.8 – 35.2	5.3	4.9 – 5.7

Table 4.1. USS ABRAHAM LINCOLN.

The second Pacific Fleet aircraft carrier studied was the USS JOHN C STENNIS. Table 4.2 displays the findings for the USS JOHN C STENNIS deployment data. A similar result was achieved when mean fill time and expected CWT were computed. The mean time to fill for WWX was lower than AMC's by 6 days. This decrease produced a 0.4-day decrease in expected CWT for WWX.

UIC	Mode	# of Document	Wholesale Mean Fill Time	90% Confidence Wholesale Mean Fill Time	Expected CWT	90% Confidence Expected CWT
R21297	AMC	2734	32.9	32.4 – 33.3	5.6	5.6 – 5.6
	WWX	162	26.9	20.5 – 33.3	5.2	4.9 – 5.6

Table 4.2. USS JOHN C STENNIS.

Table 4.3 highlights the data for the Atlantic Fleet aircraft carrier, USS GEORGE WASHINGTON. When computing mean fill time and expected CWT, AMC performed better than WWX. Mean time to fill was 5.5 days lower for AMC, resulting in a 0.4-day advantage in expected CWT for the deployment. The USS GEORGE WASHINGTON was the only aircraft carrier deployment to result in lower mean fill time and expected CWT for AMC.

UIC	Mode	# of Document	Wholesale Mean Fill Time	90% Confidence Wholesale Mean Fill Time	Expected CWT	90% Confidence Expected CWT
V21412	AMC	1422	26.8	26.0 – 27.7	5.2	5.2 – 5.3
	WWX	44	32.3	29.7 – 34.9	5.6	5.4 – 5.7

Table 4.3. USS GEORGE WASHINGTON.

The USS DWIGHT D EISENHOWER was the second Atlantic Fleet aircraft carrier in the study. The computed mean fill time was 7 days lower for WWX transactions. When expected CWT was calculated, WWX showed a 0.5-day benefit over AMC service. Table 4.4 exhibits the findings for the USS DWIGHT D EISENHOWER deployment.

UIC	Mode	# of Document	Wholesale Mean Fill Time	90% Confidence Wholesale Mean Fill Time	Expected CWT	90% Confidence Expected CWT
V03369	AMC	678	33.8	33.3 – 34.2	5.7	5.6 – 5.7
	WWX	65	26.8	25.3 – 28.2	5.2	5.1 – 5.3

Table 4.4. USS DWIGHT D EISENHOWER.

In order to achieve a more accurate picture of the effects AMC and WWX have on aircraft carrier expected CWT, the Pacific and Atlantic Fleet aircraft carrier data was combined and analyzed. Pacific Fleet aircraft carriers achieved a combined mean fill time of 31.9 days for AMC and 27.3 days for WWX transactions. This 4.6-day difference equated to a 0.2-day decrease for expected CWT for transactions shipped via WWX. Table 4.5 illustrates the findings.

	Mode	# of Document	Wholesale Mean Fill Time	90% Confidence Wholesale Mean Fill Time	Expected CWT	90% Confidence Expected CWT
PACFLT	AMC	4637	31.9	30.2 – 33.8	5.5	5.4 – 5.7
	WWX	272	27.3	20.4 – 34.3	5.3	4.8 – 5.7

Table 4.5. Pacific Fleet Aircraft Carriers.

The combined Atlantic Fleet aircraft carriers results are presented in table 4.6. The wholesale mean fill time was very similar for both AMC and WWX. A 0.1-day advantage for WWX produced the same expected CWT when computed using the CWT calculator.

	Mode	# of Document	Wholesale Mean Fill Time	90% Confidence Wholesale Mean Fill Time	Expected CWT	90% Confidence Expected CWT
LANTFLT	AMC	2100	29.1	28.3 – 29.9	5.4	5.3 – 5.4
	WWX	109	29.0	27.1 – 30.8	5.4	5.3 – 5.5

Table 4.6. Atlantic Fleet Aircraft Carriers.

Confidence levels of 90 percent were calculated for each data set to provide the reader with a sensitivity analysis for wholesale mean fill time and expected CWT. Based on the confidence levels computed for each Pacific Fleet aircraft carrier, wholesale mean fill times for AMC deviated from the mean by plus or minus 0.4 to 1.1 days with a deviation of 0.1 days for CWT. WWX confidence levels resulted in a wholesale mean fill time deviation of 6.4 to 7.2 days, which resulted in a CWT variation of plus or minus 0.4 days.

The Atlantic Fleet aircraft carriers showed a smaller confidence deviation for both AMC and WWX data. AMC variance for wholesale mean fill time was plus or minus 0.4 to 0.9 days resulting in a plus or minus 0.1-0.2 day CWT change. WWX confidence deviation was plus or minus 1.4 to 2.6 while CWT varied from plus or minus 0.1 to 0.5.

When data sets were combined for each fleet, the Pacific Fleet aircraft carriers showed a greater variance in wholesale mean fill time and CWT that the Atlantic Fleet aircraft carriers for both AMC and WWX. Pacific Fleet aircraft carriers AMC wholesale mean fill time deviated by plus or minus 1.9 days while WWX showed a plus or minus 7.0-day deviation. This deviation resulted in a CWT plus or minus range of 0.1 for AMC and 0.5 for WWX. The combined Atlantic Fleet aircraft carriers data produced a plus or minus 0.8 wholesale mean fill for AMC and plus or minus 1.8 for WWX. CWT deviation was plus or minus 0.1 for both AMC and WWX.

Further examination of the Pacific Fleet WWX data conducted identified that there were 57 requisitions out of the total 270 documents that had delivery times greater than 60 days. Of these 57 requisitions, 22 documents had delivery times greater than 120 days. The removal of these perceived outliers would have significantly improved the

confidence range for WWX documents and improved mean fill times and CWT figures. Additionally, differences in data set population for AMC and WWX contributed to the difference found in the confidence analysis. The total AMC data set collected for both fleets exceeded 6700 documents while WWX only had 379 documents for both fleets.

Based on this research study, WWX improved mean fill time in the three of four aircraft carriers studied, but had little impact on CWT and readiness. The one aircraft carrier that resulted in a positive mean fill time and CWT while using AMC was the USS GEORGE WASHINGTON. Further calculations and analysis were performed to determine the effect of perceived data outliers. To understand the effect the perceived outliers had on the results, all requisitions that had a mean fill time of 60 days or greater were removed and the data analyzed. Three of the four aircraft carriers that had lower CWT while using WWX recorded almost identical statistical results to the initial analysis. The variance of the mean time was reduced significantly while CWT was slightly lower after the perceived outliers were removed from the data set. The fourth aircraft carrier, the USS GEORGE WASHINGTON showed a statistical difference in the modified data set. Removing the perceived outliers significantly reduced the data set for both AMC and WWX. AMC documents were reduced from 1422 to 1303 or 8.3, percent while the WWX document set decreased from 44 to 38 or 13.6 percent. This change in data reversed the original outcome from a 5.6-day advantage for AMC to a 2.8-day benefit for WWX.

3. Effects on Readiness

The relationship between CWT and readiness is represented by the following equation:

$$A_o = \frac{\textbf{MTBF}}{\textbf{MTBF + MTTR + CWT}} \quad \textbf{where}$$

MTBF = Mean Time Between Failure
MTTR = Mean Time to Repair
MSRT = Mean Supply Response Time
MSRT = Customer Wait Time

In order to compare the change in readiness for AMC and WWX deployments to the Arabian Gulf, baseline variables along with the Chief of Naval Operations (CNO) overall deployed aircraft carrier readiness goals need to be used to compute MTBF. (CNO LTR dtd 19 January 1993) Using a 78 percent mission capable rate as directed by the CNO, two hours (.0833 days) for the MTTR and 4.4 days for MSRT, MTBF is calculated to be 20.38 days. (PHONCON; CDR Hoover, May 2001)

To calculate the change in Mission Capable (MC) rates using AMC and WWX for Pacific Fleet aircraft carriers, expected CWT figures calculated in the study were substituted for the baseline figure of 4.4. Additionally MTBF and MTTR were held constant at 20.38 days and 2 hours (.0833 days). The following equations were calculated:

$$A_{o\,(AMC)} = \frac{20.38}{20.38 + .0833 + 5.5} \Rightarrow 78.5\%\ \text{MC}$$

$$A_{o\,(WWX)} = \frac{20.38}{20.38 + .0833 + 5.3} \Rightarrow 79.1\%\ \text{MC}$$

Based on the above results, a 0.2-day improvement in CWT equates to a 0.6 percent increase in MC readiness rates for Pacific Fleet aircraft carriers.

Full Mission Capable (FMC) rates were also calculated using the baseline figures above and substituting the CNO FMC rate of 68 percent for the MC rate of 78 percent.

Based on these figures MTBF was calculated to be 12.1 days. The following equations represent Pacific Fleet aircraft carrier FMC rates based on expected CWT values for this study:

$$\mathbf{A_{o\,(AMC)} = \frac{12.1}{12.1 + .0833 + 5.5} \Rightarrow 68.4\%\ FMC}$$

$$\mathbf{A_{o\,(WWX)} = \frac{12.1}{12.1 + .0833 + 5.3} \Rightarrow 69.1\%\ FMC}$$

A .08 percent improvement in FMC rates was achieved when comparing WWX to AMC for Pacific Fleet aircraft carriers.

MC and FMC rates were not calculated for Atlantic Fleet aircraft carriers as expected CWT was the same for AMC and WWX. This would not result in a difference in readiness rates between the two modes of transportation.

4. Customer Confidence

In order to identify customer confidence in AMC and WWX, a web-based survey was conducted for aircraft carrier supply personnel and fleet staffs. The "Survey Said" web-based program was used to solicit responses from participants. The survey was available on the World Wide Web for two weeks and Pacific and Atlantic Fleet Aviation Type Commanders Deputy Force Supply Officers requested participation via email to each aircraft carrier. Results were received from 13 people in the solicited population. The survey consisted of 14 questions designed to identify the participants, their level of usage and levels of confidence for both AMC and WWX under different categories of scrutiny.

To identify the level of importance to the survey participants of TDD and Intransit Visibility (ITV), participants were asked to identify which was more important to them.

Figure 4.1 show that 85 percent of the participants valued TDD, the ability of a carrier to guarantee its delivery time frame.

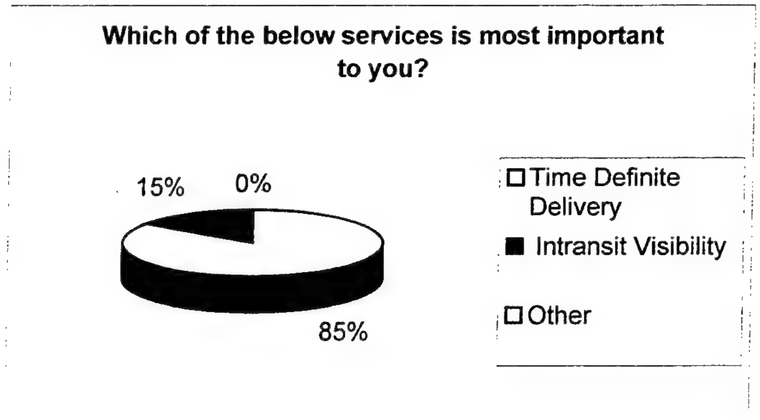

Figure 4.1. Level of Importance of TDD and Intransit Visibility (ITV).

The following set of questions concentrated on rating AMC and WWX on their ability to meet their flight schedules. Figure 4.2 illustrates the AMC question as presented on the survey, which rated three specific AMC cargo channel aircraft types. Figure 4.3 highlights the ratings given to WWX for their ability to meet their schedule. While both carriers received at least one poor rating, WWX was rated as outstanding and excellent by 82% of the respondents. AMC was rated as fair by 62% of the respondents and only received a 15 % outstanding rating.

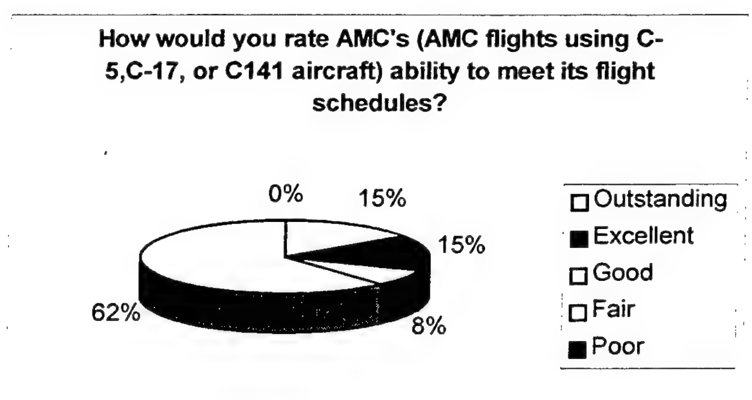

Figure 4.2 AMC Question.

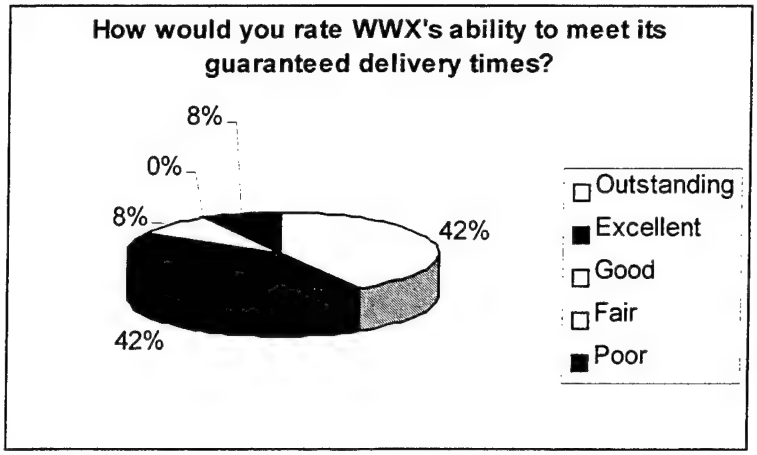

Figure 4.3. Ratings Given to WWX.

To identify the survey participants overall confidence level when using AMC and WWX services, the questions highlighted in Figures 4.4 and 4.5 were asked. The majority of the participants rated their confidence level that material shipped via AMC would arrive when expected as fair (54 percent). Only 33 percent believed their service to be worthy of an outstanding or excellent rating. The WWX service received a majority rating of both outstanding and excellent with each scoring 46 percent of the participant's responses.

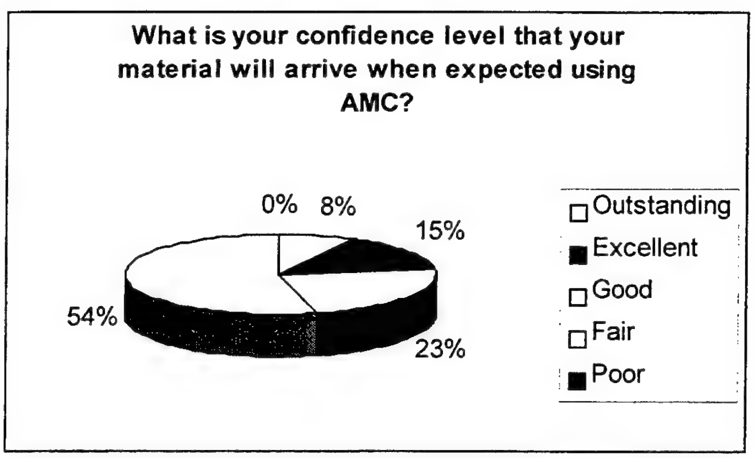

Figure 4.4. Confidence Level with AMC.

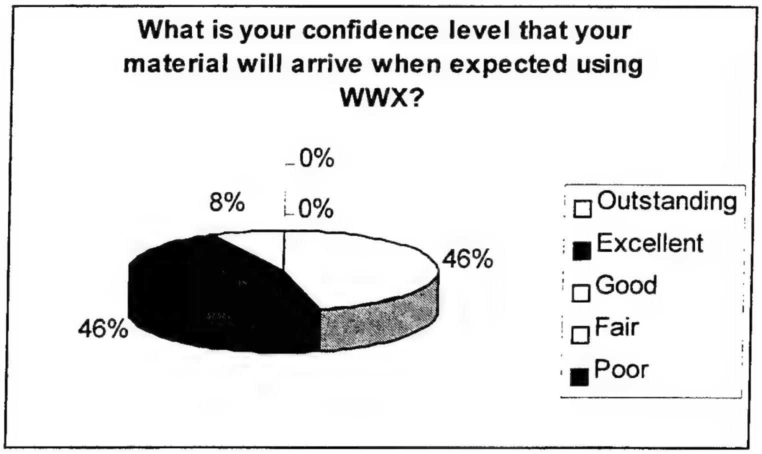

Figure 4.5. Confidence Level with WWX.

The final question each participant answered is depicted in figure 4.6, WWX was chosen by 77 percent of the participants. AMC received 15 percent of the vote; 8 percent of the respondents selected commercial premium airline shipments, such as United, American and Delta as their method of choice.

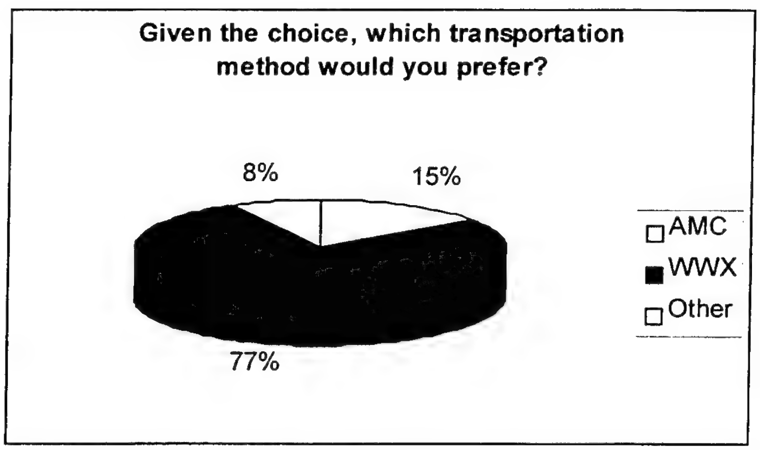

Figure 4.6. Preferred Transportation Method.

C. RESULTS

Upon assessing, it is apparent that the variance between the mean fill times for wholesale shipments between AMC and WWX were significant, but had little effect on expected CWT. In the case of the Pacific Fleet aircraft carriers and Atlantic Fleet aircraft

carrier deployments, AMC and WWX recorded mean fill time differences between two to seven days; three aircraft carriers in favor of WWX and one in favor of AMC. While this may seem significant when waiting for high priority material shipments on deployment, it had minimal effect on expected CWT, ranging from 0.2 to 0.5-days. This results from the small weighted value that wholesale shipments have on the overall CWT calculation. While the majority of issues (75 percent) come from the retail level, with 66 percent of the material being repaired at the maintenance level, wholesale issues carry less weight when it comes to CWT as a whole.

Thirteen participants responded to the confidence survey. WWX was the significantly preferred mode of transportation. Confidence levels were high for service performance standards and expectations. Additionally, respondents rated ITV for WWX via the World Wide Web considerably more reliable for status information than from GTN and AMC information. While this survey may not represent the majority of the available population, it provides an indication of customer confidence and preference.

Based on this study, full implementation of WWX for Pacific Fleet aircraft carriers deployed to the Arabian Gulf will slightly improve readiness. This study concluded that Pacific Fleet aircraft carriers readiness rates improved by 0.6 percent for MC rates and 0.8 percent for FMC rates based on wholesale level issues using WWX. Atlantic Fleet aircraft carriers showed no difference in readiness rates when using WWX or AMC as their transportation mode.

D. SUMMARY

This chapter analyzed the results of this research using the methodology prescribed in the previous chapter. The focus has been on variances between AMC and

WWX involving wholesale mean fill time, CWT metrics, and their effect on readiness for aircraft carriers deployed to the Arabian Gulf. Additionally, a survey of aircraft carrier and Type Commander staff personnel provided a snapshot of customer confidence with respect to AMC and WWX. These results show the following:

- Wholesale mean fill times for Pacific Fleet aircraft carriers were 31.9 (+/- 1.9) days for AMC and 27.3 (+/-7.0) days for WWX
- Wholesale mean fill times for Atlantic Fleet aircraft carriers were 29.1 (+/- 0.8) days for AMC and 29.0 (+/- 1.8) days for WWX
- Expected CWT for Pacific Fleet aircraft carriers on deployment to the Arabian Gulf were 5.5 (+/- 0.2) days for AMC and 5.3 (+/- 0.4) days for WWX
- Expected CWT for Atlantic Fleet aircraft carrier on deployment to the Arabian Gulf were 5.4 (+/- 0.1) days for AMC and 5.4 (+/- 0.1) days for WWX
- MC rates improved by 0.6 percent for Pacific Fleet aircraft carriers on deployment to the Arabian Gulf when using WWX
- FMC rates improved by 0.8 percent for Pacific Fleet aircraft carriers on deployment to the Arabian Gulf when using WWX
- Atlantic Fleet aircraft carriers showed no change in readiness rates when using WWX
- Customer confidence was improved when using WWX

The final chapter of this research draws upon the analysis above to provide the authors conclusions and recommendations and suggestions for further research.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This chapter provides an overview of the research project. It draws on the analysis contained in the previous chapter to draw conclusions about CWT and readiness with respect to AMC and WWX. It then provides recommendations based on the authors research, discusses the findings and concludes with recommendations for future research.

B. CONCLUSIONS

1. Research Synopsis

The primary conclusion drawn from this study is that using WWX for wholesale level issue of parts for aircraft carriers deployed to the Arabian Gulf had minimal impact on CWT. Although significant reductions in mean fill time were observed for three aircraft carriers using WWX and one aircraft carrier using AMC, the weighted impact on CWT was negligible considering the importance that retail issues and intermediate maintenance level actions carry in the CWT equation. Retail issues account for 75 percent of initial issues while intermediate maintenance actions account for 66 percent of repairable actions. When Pacific Fleet aircraft carrier data was combined, it resulted in a slight improvement in CWT when using the WWX service. Individually, each Pacific fleet aircraft carrier showed an improvement of two to seven days in wholesale mean fill times, which improved CWT by 0.2-0.5 days.

These positive results may be attributed to the more mature WWX procedures within the Pacific Fleet. The combined results for Atlantic Fleet carriers did not show any difference in CWT for either transportation mode. Individually, each Atlantic Fleet aircraft carrier showed contrasting results in favor of AMC and WWX for both wholesale

mean fill times and CWT. These outcomes may result from the limited use of WWX for Atlantic Fleet aircraft carriers due to the close proximity of Naval Air Station Norfolk, as well as different expediting procedures among each fleet staff. Although a small improvement in readiness was observed for Pacific Fleet aircraft carriers and no improvement for Atlantic Fleet aircraft carriers, WWX may have more of an effect on readiness with respect to stock replenishments. If stock replenishment shipments were to see a two to five day improvement on mean fill times, onboard retail issues would be positively impacted and have a greater effect on readiness rates throughout the fleet. Additionally, the institution of a TDD schedule along with World Wide Web based ITV would greatly enhance supply effectiveness and build greater customer confidence in the supply system.

C. RECOMMENDATIONS

1. Conclusions

The following research questions are answered based on the conclusions drawn from this study:

a. What is the Difference in CWT between AMC and WWX Service during a Deployment to the Arabian Gulf?

CWT was slightly affected by transportation mode. During individual aircraft carrier deployments, WWX improved CWT for both Pacific Fleet aircraft carriers and one Atlantic Fleet aircraft carrier. **RESULTS:**

- Expected CWT for the USS ABRAHAM LINCOLN on deployment to the Arabian Gulf was 5.5 (+/- 0.1) days for AMC and 5.3 (+/- 0.4) days for WWX
- Expected CWT for the USS JOHN C. STENNIS on deployment to the Arabian Gulf was 5.6 (+/- 0.0) days for AMC and 5.2 (+/- 0.4) days or WWX

- Expected CWT for the USS GEORGE WASHINGTON on deployment to the Arabian Gulf was 5.2 (+/- 0.1) days for AMC and 5.6 (+/- 0.2) days for WWX
- Expected CWT for the USS DWIGHT D EISENHOWER on deployment to the Arabian Gulf was 5.7 (+/- 0.1) days for AMC and 5.2 (+/- 0.1) days for WWX

b. Does the WWX Program Improve CWT to Fleet Units during a Deployment to the Arabian Gulf?

When aircraft carrier data was combined, WWX improved Pacific Fleet aircraft carriers CWT by 0.2-days. Atlantic Fleet aircraft carriers showed no difference in CWT with respect to mode of shipment. **RESULTS:**

- Expected CWT for Pacific Fleet aircraft carriers on deployment to the Arabian Gulf was 5.5 (+/- 0.2) days for AMC and 5.3 (+/- 0.4) days for WWX.
- Expected CWT for Atlantic Fleet aircraft carrier on deployment to the Arabian Gulf was 5.4 (+/- 0.1) days for AMC and 5.4 (+/- 0.1) days for WWX

c. Will Full Implementation of the WWX Program Improve Readiness for Deployed Units in the Arabian Gulf?

Readiness was improved slightly for Pacific Fleet aircraft carriers when using WWX. Since there was no difference in CWT for AMC and WWX for the Atlantic Fleet, readiness was also not affected. Since this study is a snapshot of the affects of premium transportation, a definite endorsement for WWX would be premature and would require a more intense study to include the effects on stock replenishment and overall supply effectiveness. **RESULTS:**

- MC rates improved by 0.6 percent for Pacific Fleet aircraft carriers on deployment to the Arabian Gulf when using WWX
- FMC rates improved by 0.8 percent for Pacific Fleet aircraft carriers on deployment to the Arabian Gulf when using WWX
- Atlantic Fleet aircraft carriers showed no change in readiness rates when using WWX

d. *Does The WWX Program Provide Better Customer Confidence than AMC?*

When surveying customers and expeditors, we determined that TDD was the most important factor among respondents. Although ITV was important, respondents felt that guaranteed delivery times were more critical than ITV and is a positive aspect of WWX. The majority of the respondents felt more confident that material shipped via WWX would arrive as expected than on AMC aircraft. Additionally, WWX invoked more confidence for the participants when schedule fulfillment was compared with AMC. Customer confidence was highest when WWX was the transportation mode. Finally, given a choice, WWX was the transportation mode selected by the majority of the respondents.

2. Recommendations Based on Research

- WWX provides superior service and should continue as a mode of shipment for aircraft carriers to the Arabian Gulf. It should be expanded to include all surface ships in the battlegroup when deployed to the Arabian Gulf
- Further examination of mean fill time data should be examined as WWX data becomes more readily available
- Atlantic Fleet aircraft carriers and surface ships should expand their use of WWX to the Arabian Gulf
- The viability of the WWX program for afloat units in the Mediterranean AOR should be investigated
- Hazardous Material should be classified to ensure that Repair Parts with small batteries or other like items are not classified as hazardous material and preclude them from being shipped by WWX
- An automated decision table should be designed to determine the first to arrive method of shipment vice the next flight out method. This will preclude the instance when an item is loaded on the next flight out, but arrives later than the later flight because the aircraft are routed differently to the same location

3. Future Research Topics

In order to more adequately analyze the supply transportation system and how it can improve CWT and readiness, the following research topics warrant further study:

- Investigate CWT and its effect on readiness for aircraft carriers in the Mediterranean
- Study the effect that WWX has on stock replenishments and its overall affect on supply gross effectiveness
- Determine the outcome of readiness levels when WWX is fully implemented to include stock replenishments
- Determine the costs and benefits that full implementation of the WWX program will have on the Department of Defense
- Survey fleet units and ashore activities to determine if WWX provides better confidence than AMC
- Determine the effect that pre-positioning assets in Memphis has on CWT
- Study the effects that WWX has on transportation time for DLR Retrograde Shipments to Repair Depots
- Determine the effect that full implementation of the WWX program will have on manpower requirements

D. THESIS SUMMARY

In today's downsizing environment and exceedingly volatile world, the United States military is increasingly reliant on rapid transportation to maintain readiness levels. Improvements in the commercial transportation industry have allowed the military to take advantage of the services enjoyed for years by private industry. These advanced air commercial cargo transportation technologies coupled with our military air cargo resources enhance our abilities to support our fleet and maintain our readiness levels at their highest levels within resource constraints. The WWX program has demonstrated its ability to improve mean fill time, CWT and readiness levels to the Arabian Gulf. The need to expand WWX to the Arabian Gulf is warranted and should be used as a complement to the service that AMC currently provides.

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APPENDIX. AMC/WWX CUSTOMER SURVEY

1. This survey is being conducted in conjunction with a thesis on the World Wide Express Program. In order obtain customer feedback on the program we're asking that you complete this brief survey form.

2. Identify your Command and Position.

Pacific Fleet Carrier	Atlantic Fleet Carrier
Supply Officer	Supply Officer
Readiness Officer	Readiness Officer
S-6 Officer	S-6 Officer
Tender Supply Officer	Cargo Officer
Pacific Fleet Staff	Staff Expeditor
Atlantic Fleet Staff	Staff Expeditor
Other (Specify)	

3. How long has your activity used WWX?
   Less than 6 months
   6-12 months
   12-18 months
   19-24 months

4. Which of the below services is most important to you?
   Time Definite Delivery (guaranteed delivery times/WWX or AMC Flight Schedules)
   Intransit Visibility (the ability to track and trace material shipments)
   Other (Specify)

5. How would you rate AMC's (AMC flights using C-5;C-17; or C141 aircraft) ability to meet its flight schedules?
   Outstanding
   Excellent
   Good
   Fair
   Poor

6. What is your confidence level that your material will arrive when expected using AMC? Outstanding
   Excellent
   Good
   Fair
   Poor

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7. How would you rate WWX's ability to meet its guaranteed delivery times?
   Outstanding
   Excellent
   Good
   Fair
   Poor

8. What is your confidence level that your material will arrive when expected using WWX?
   Outstanding
   Excellent
   Good
   Fair
   Poor

9. Which system offers the easiest tracking method?
   AMC
   WWX

10. What is your confidence level of the material status for AMC shipments using the Global Transportation Network (GTN)?
    Outstanding
    Excellent
    Good
    Fair
    Poor

11. What is your confidence level of the material status for WWX shipments using the Global Transportation Network (GTN)?
    Outstanding
    Excellent
    Good
    Fair
    Poor

12. What is your confidence level of the material status for WWX shipments using the World Wide Web page for the specific WWX carrier?
    Outstanding
    Excellent
    Good
    Fair
    Poor

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13. Given the choice; which transportation method would you prefer?
    AMC
    WWX
    Other (Specify)

14. We'd appreciate any additional comments you might have on WWX; AMC; or related transportation services. Please provide them below.

Thank you for your time and comments.

Enclosure 1

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